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SHORT COMMUNICATION

HUNGRY SPIDERS AREN'T AFRAID OF THE BIG BAD WOLF SPIDER

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ABSTRACT. Foraging behavior in spiders can be influenced by a variety of factors. Here we investigate the effects of hunger and predation risk on feeding behavior in the wolf spider *Pardosa milvina* (Hentz 1877) (Araneae, Lycosidae). *Pardosa milvina* is preyed upon by the larger wolf spider, *Hogna helluo* (Walckenaer 1837), and responds with appropriate antipredator behavior to the silk and feces of this species. We predicted that hungry *Pardosa milvina* would be more likely to forage and consume prey under predation risk than satiated individuals. We found that hungry *Pardosa* under predation risk consumed as many prey as spiders not under predation risk. However, satiated *Pardosa* consumed significantly fewer prey when under predation risk. Our data suggest that the animal's energetic needs are weighed against the risks of foraging when predators may be present.

Keywords: Wolf spider, predation risk, hunger, foraging

The fitness of an animal, especially spiders, can be influenced by its foraging success (e.g. Uetz 1992). Often, foraging decisions that result in very high rewards are not the safest and animals weigh their current needs versus the level of risk involved (Lima & Dill 1990). That is, animals that are in need of energy will be more willing to take risks while foraging compared to well-fed or satiated animals (reviewed in Lima 1998a, b). Previous research has demonstrated that *Pardosa milvina* (Hentz 1877) is sensitive to predation risk (Persons & Rypstra 2001; Persons et al. 2001, 2002) and that individuals are not sensitive to changes in their energetic state as a result of decreased foraging success (Walker et al. 1999). However, we have not examined how changes in energetic state influence an individual's response to predation risk.

Pardosa milvina is a common cursorial spider in agricultural systems and early succesional habitats throughout the eastern United States (Dondale & Redner 1990; Marshall & Rypstra 1999). *Pardosa milvina* is frequently preyed upon by the much larger wolf spider *Hogna helluo* (Walckenaer 1837) and exhibits behaviors that reduce its level of predation risk in the presence of silk and excreta from the much larger *H. helluo* (Persons & Rypstra 2001; Persons et al. 2001, 2002). *Pardosa milvina* reduces its locomotor activity when on and avoids substrates that contain silk and excreta from *H. helluo* (Persons & Rypstra 2001; Persons et al. 2001, 2002). These behaviors result in increased survival of *P. milvina* in the presence of *H. helluo* even though they result in decreased feeding and reproductive success (Persons et al. 2001, 2002). Manipulating foraging success in *P. milvina* results in changes in body condition and presumably hunger in *P. milvina*, but does not affect locomotor activity (Walker et al. 1999). However we do not know if *P. milvina* will weigh its current energetic needs (e.g., a state of "hungry" versus a state of "satiated") when simultaneously faced with avoiding a predator and capturing prey. We conducted laboratory experiments to determine if predation risk and hunger simultaneously influence the number of prey captured by *P. milvina*.

For all experiments, subadult *P. milvina* were collected in May of 1998 from soybean fields at Miami University's Ecology Research center (Oxford, Butler County, Ohio, USA) and then raised in the lab to maturity. *Hogna helluo* used in this study were lab-reared offspring of individuals collected the previous year from the Ecology Research Center. Vouchers of both species are available from the Hefner Zoology Museum at Miami University. *Pardosa milvina* were maintained in 5.5 cm high × 5.5 cm diameter plastic containers and *H. helluo* were

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Table 1.—Mean number of fruit flies (S.E. in parenthesis) consumed by *P. milvina* in different treatments. Significant differences between treatments are denoted by different letters.

Hunger level	Predation risk	*n*	Number of flies consumed
Low	High	10	2.0 (0.17) A
High	High	10	3.4 (0.34) C
Low	None	8	4.7 (0.22) B
High	None	9	4.3 (0.37) BC

maintained in 8 cm high × 12 cm diameter containers (Walker et al. 1999; Persons et al. 2001, 2002). The bottom of all containers was filled with damp peat moss. Both species were maintained on a diet of domestic crickets (*Acheta domesticus* (Linnaeus 1758)).

To determine if *P. milvina* prey consumption was influenced by hunger and predation risk we counted the number of vestigial winged fruit flies (*Drosophila melanogaster* Meigen 1830), out of 5, consumed by individuals at different levels of hunger and predation risk in a 2 × 2 factorial design. To begin, we standardized hunger level by feeding animals to satiation. One group was then fed three times over the following week and the other was not fed at all. This manipulation results in changes in body condition (e.g. fasted animals are have lower body condition than animals in the high food treatment) and if we assume that this morphological indicator reflects internal state, then fasted animals should be hungrier than animals receiving food (see Walker et al. 1999). Predation risk was manipulated by moving spiders from their original containers to same sized containers (e.g., 5.5 cm × 5.5.cm) that either previously contained or never contained an adult female *H. helluo* for the previous 24 hours. This protocol, which places individual *P. milvina* in close proximity to the silk and excreta of *H. helluo*, is similar to what we have used in other studies to convey predation risk to *P. milvina* (Persons et al. 2001; 2002). We then added 5 fruit flies to each container and recorded the number captured and consumed over the next 1.5 h (see Persons et al. 2002). A total of 37 individual *P. milvina* were used in these experiments. The number of individuals used in each treatment is shown in Table 1. The total number of fruit flies consumed by an individual spider was compared across treatments using a two-factor analysis of variance and post-hoc comparisons were done using a Tukey-Kramer procedure.

The two-factor ANOVA showed significant effects of predation risk ($F_{(1,33)} = 36.1$, $P < 0.0001$) and the interaction between hunger level and predation risk ($F_{(1,33)} = 9.64$, $P = 0.0039$). However, there was no significant effect of hunger level ($F_{(1,33)} = 2.825$, $P = 0.1022$). Post-hoc comparisons showed that satiated spiders under predation risk consumed fewer flies than those not under predation risk; however, there was no significant difference between the number of flies consumed by hungry spiders under predation risk and hungry spiders not under predation risk (Table 1).

Research has repeatedly shown that *P. milvina* assesses and responds to the risks associated with predation (Persons & Rypstra 2001; Persons et al. 2001; 2002). In this study, we show that *P. milvina* are not only sensitive to predation risk but also their own energetic state when making foraging decisions. Hungry spiders are more willing to forage and capture prey under predation risk than are satiated spiders. These data add further support to the hypothesis that an animal's behavior is sensitive not only to predation risk but also energetic needs (for reviews Lima & Dill 1990; Lima 1998a, b).

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